Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to overcome Examiners objections and to correct grammatical errors to clarify Applicants disclosed and claimed invention.

Support for the amended claims is found in the original claims and/or the Specification. No new matter has been added.

For example support for new claims 41 and 42 is found in the Specification at paragraph 0016:

"Still referring to Figure 1A, in an exemplary embodiment of the present invention, an **optional interfacial layer** 14A, also referred to as a base layer, formed of SiO_2, SiON, or SiN, or combinations thereof is formed on the substrate 12. The interfacial layer 14A may be formed by one or more of CVD

deposition, wet or dry (plasma) chemical reaction (oxidation), thermal oxidation, and nitridation."

Claim Rejections under 35 USC 112

The claims have been amended to overcome Examiners rejections.

Claim Rejections under 35 USC 102(e)/103

1. Claims 22-26, 28, 29, 39, and 40 stand rejected under 35 USC 102(e) as being anticipated by, or in the alternative, under 35 USC 103(a) as unpatentable over Parker et al (US 6,787,440).

Parker et al. disclose a method for making a semiconductor device where a buffer layer is formed between a substrate and a high-K dielectric layer (see Abstract). The buffer layer is taught to be formed for the purpose of avoiding shorting through a thin gate dielectric (col 1, lines 35-36). In addition Parker et al. teach reoxidizing (e.g., col 3, lines 11-15) the high-K dielectric layer **following formation of the high-K dielectric on**

the buffer layer to improve an interface between the high-K dielectric and the gate electrode (col 1, lines 38-40; col 2, lines 21-30). A gate electrode is formed on the high-K dielectric following the reoxidation process (col 3, lines 66-67). In another embodiment the high-K dielectric layer is formed directly on the substrate and the buffer layer formed **between the high-K dielectric and the substrate** (col 4, lines 16-21) **during reoxidation of the high-K dielectric layer** (col 4, lines 38-46). Parker et al. disclose that the buffer layer is formed of silicon dioxide or silicon oxynitride((col 2, lines 35-39).

Thus, Parker et al. disclose an entirely different structure that Applicants disclosed and claimed invention. Parker et al. do not disclose several aspects of Applicants disclosed and claimed invention including:

"a buffer dielectric layer on the high-K gate dielectric the buffer dielectric layer comprising dopants selected from the group consisting of a metal, a semiconductor, and nitrogen; and,

a gate electrode layer on the buffer dielectric layer."

Parker et al. is clearly insufficient to anticipate or make out a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

Moreover, Parker et al. teach directly away from Applicants disclosed and claimed invention by teaching the formation of the gate electrode on the high-K dielectric. The structure of Parker et al. presents the very problem that Applicants disclosed and claimed invention overcomes: "A gate structure with a reduced Voltage threshold (V_{th}) shift".

The structure of Parker et al. with a buffer layer **between the high-K dielectric layer and the substrate** (e.g., either a gate dielectric substrate or a semiconductor substrate) works by a different principal of operation that Applicants disclosed and claimed invention (the buffer layer between the gate electrode and the high-K dielectric layer). In addition, Parker et al. nowhere recognizes the problem that Applicants have recognized

and solved by their disclosed and claimed invention.

Applicants respectfully reject Examiners assertion of Official Notice regarding any suitable materials enumerated in Applicants claims are anticipated or rendered obvious even if not included in the teachings of Parker et al.

Since Examiner has failed to make out *a prima facie* case of obviousness with respect to Applicants independent claims, neither has one been made out with respect to dependent claims.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

"A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997).

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc., 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983); cert denied, 469 U.S. 851 (1984).*

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art

invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).*

2. Claim 27 stands rejected under 35 USC 103(a) as unpatentable over Parker et al. above taken with Dimmler et al. (US 6,787,440).

Applicants reiterate the comments made above with respect to Parker et al.

Dimmler discloses a ferroelectric FET structure having a completely different structure and working by a different principal of operation than either Parker et al. or Applicants disclosed and claimed invention. For example, Parker et al. discloses in one embodiment a top buffer layer which is formed between the gate electrode and a top ferroelectric region where the top ferroelectric region overlies a gate oxide layer which in turn overlies a bottom ferroelectric region (see Figure 6).

Even assuming *arguendo* proper motivation for combining the

teachings of Dimmler and Parker et al., such combination does not produce Applicants disclosed and claimed invention.

With respect to claims 34 through 38, Applicants reiterate the comments made above with respect to Parker et al. and Dimmler.

Although not specifically stated, apparently, Examiner is rejecting claims 34-38 over Parker et al. and Dimmler in further view of Nishikawa et al. (US Pub 2004/0096692), Kim et al. (US 6. 727,130) and Xiang (US 6, 734, 526).

The fact that Xiang discloses that Hafnium silicates and aluminum oxide may be used as high-K dielectric materials does not further help Examiner in establishing a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

Even assuming arguendo proper motivation for combining Nishikawa et al. with any or all of the above cited references

The fact that Nishikawa et al. disclose "After an underlying layer, made of a single crystal metal material, has been formed on a semiconductor layer, part or all of the underlying layer is **changed into a metal oxide layer** by supplying oxygen thereto from above the underlying layer. Then, a ferroelectric or high-dielectric-constant film is further formed on the metal oxide layer" (see Abstract) does not further help Examiner in establishing a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

The fact that Kim et al. (6,727,130) teach using including Al2O3 and HFSiO2 to form a gate dielectric layer does not further help Examiner is establishing a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

"A statement that modifications of the prior art to meet the claimed invention would have been "'well within the ordinary skill of the art at the time the claimed invention was made'" because the references relied upon teach that all aspects of the

claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references." Ex parte Levengood, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993).

"The fact that references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references." *Ex parte Levengood, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993).*

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a

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condition for allowance.

Respectfully submitted,

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